Using the Toxic Exposure Surveillance System for Public Health Surveillance

A Collaborative Effort of the Centers for Disease Control and Prevention and the American Association of Poison Control Centers

Overview
The American Association of Poison Control Centers (AAPCC) and the Centers for Disease Control and Prevention (CDC) have combined efforts to help local poison control centers (PCCs) detect chemical exposure events and ensure effective responses. The focus of these efforts is to use the Toxic Exposure Surveillance System (TESS) database to improve public health surveillance of chemical exposures and other potential health hazards. Every 4 to 10 minutes, 62 regional poison control centers upload case data to TESS, which is operated at AAPCC. CDC and AAPCC have developed methods to use TESS data for real-time automated alerting that will generate more immediate and effective responses to public health threats related to toxins or chemicals in the environment. The TESS database is a flexible and adaptable system that can be used to:
- identify early indicators for chemical exposures occurring at multiple sites throughout the United States;
- identify emerging problems that may be associated with newly introduced household products, pharmaceuticals, or pesticides;
- identify illnesses resulting from intentional or unintentional chemical exposures at a single site or across multiple locations; and
- monitor the frequency of reports involving potentially abused substances.

How information is collected using TESS
Operational since 1985, TESS is the only poisoning surveillance database in the United States, representing 99.8% of all poison exposures reported to poison control centers nationwide. TESS currently logs 2.2 million poison exposures annually from 62 of the 63 U.S. poison control centers. The cumulative TESS database contains information about more than 36.2 million human poison exposure cases. TESS annual reports, a TESS brochure, and an order form for TESS data are available on the TESS Web site at http://www.aapcc.org/poison1.htm.

The data fields for TESS include case information (center, date), call information (exposure site, reason for exposure), caller information (location by zip code, county, state), patient information (age, sex, pregnancy), exposure information (acuity, duration, number of substances, route of exposure, substance, and amount), and information about case management (management site, therapy), medical outcomes, and toxic effects.

How TESS is used to detect outbreaks
Three approaches are currently being implemented for using TESS data to detect outbreaks. These approaches use surveillance of (1) call volume, (2) clinical effects, and (3) specific case and exposure

definitions. For each of these approaches, analytical methods are applied to detect aberrations that may identify an outbreak and enable a rapid and appropriate public health response.

Call volume
The approach to surveillance using call volume monitors the hourly volume of calls that involve human exposures at each regional PCC. The number of hourly reported calls to a specific PCC is compared with historical data for that particular hour.

Clinical effects
The approach using clinical effects monitors 131 unique "clinical effects," including physical findings (e.g., slow heart rate), diagnostic tests, and laboratory results. This approach monitors information about each of the 131 clinical effects captured in the national database over a 24-hour interval and compares that data with historical data.

Case and exposure definitions
The approach that uses case and exposure definitions identifies sentinel cases in which people may have been exposed to a particular substance, or tracks the frequency of occurrence of such cases. The various case and exposure definitions are based on combinations of variables including clinical effects, exposure substances, medical outcome severity, and route of exposure. Uses of case and exposure definitions for surveillance include the following:

1. Identification of illnesses caused by specific toxins or toxicants (e.g., cyanide, arsenic, pufferfish poisoning) that otherwise may have gone unrecognized by traditional surveillance systems

2. Frequency tracking of cases of people exposed to individual or groups of substances (e.g., contaminated water, contaminated food)

How TESS is used to determine whether a public health investigation is warranted

Step 1
AAPCC and CDC toxicologists and epidemiologists analyze the processed surveillance data to determine whether a public health investigation is appropriate. The analyses used in this process include (1) investigating clinical effects to assess whether they match those expected for the identified substance, (2) determining whether a cluster of aberrations exists in time and space, and (3) judging whether an unusual pattern of severity is shown by the recorded outcome (classified as moderate, severe, or death).

Step 2
After reviewing the data, AAPCC and CDC determine whether the appropriate PCC should be contacted to gather additional information.

Step 3
If the information from the PCC suggests that an event warrants further investigation, the reporting PCC notifies the local or state health department.

How TESS is being evaluated
Several aspects of the database are currently being evaluated by CDC through various methods to determine how well the system performs. Specific areas of evaluation include sensitivity of aberrancy

detection and syndrome case definitions, comprehensiveness of data coding, timeliness of reporting, and robustness of statistical methods. Other areas that will need investigation include the following:

- Degree of variability among regional centers in the actual penetrance or percentage of population covered
- Accuracy and completeness of coding standards, which may depend on factors such as call volume, operator familiarity with coding, operator experience, and willingness of an operator to code
- Obtaining data recorded in text fields that may not be uploaded to TESS
- Possible delays in uploading data from the local PCC caused by large call volumes, technical difficulties, and lack of resources

How a national surveillance program will assist in preventing accidental poisonings

Using TESS as part of a national surveillance program will improve the ability of PCCs to respond to public health emergencies related to chemicals or toxins in the environment. National surveillance information collected about contaminated or tampered water, food, medication, or other products can provide a basis for establishing historical definitions for specific events with similar patterns. The following are examples of how national surveillance has been used to assess potential threats and prevent further contamination.

Arsenic Poisoning in Maine, 2003

AAPCC received alerts within 24 hours of an arsenic outbreak and before the detection of arsenic in coffee consumed by attendees at a church gathering. After receiving the initial alert, CDC and AAPCC contacted the Maine Bureau of Health and the New England PCC to confirm the outbreak and offer assistance with public health intervention. Following the determination that the coffee was contaminated with arsenic, active surveillance was initiated to search for similar patterns of cases throughout the United States. The surveillance was set up to identify cases with clinical effects similar to those associated with the cluster in Maine.

Paraquat on Truck Missing in Canada, 2003

After a truck containing paraquat was stolen in Canada, CDC and AAPCC quickly developed surveillance case definitions for paraquat because of increased concern about a potential release of paraquat into U.S. communities. The enhanced national surveillance system searched for cases that included a reported paraquat exposure and a combination of clinical effects consistent with exposure to paraquat.

Contaminated Imported Fruit, 2004

Information was received that a shipment of apples from South America could be contaminated with long-acting anticoagulants (brodifacoum and brodifacoum-like agents). CDC and AAPCC initiated surveillance for cases with coagulation abnormalities or bleeding. Also, all PCCs were informed of the potential threat.

Ricin Letter in South Carolina Postal Facility, 2004

After an envelope was found containing ricin and a note threatening to poison the water supply, CDC and AAPCC (1) conducted daily surveillance to monitor counts from each PCC for the specific product codes "contaminated water" and "food poisoning/contamination" and (2) developed surveillance case definitions for ricin poisoning.

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(continued from previous page)

Northeast Blackout, 2003
CDC and AAPCC were concerned about potential health hazards following the power blackout in the northeastern United States during August 2003. Active surveillance identified 93 calls regarding exposure to or questions concerning spoiled food and 114 calls concerning contaminated water. The increase in calls was limited to calls from states that experienced the blackout.

For more information
Callers can contact the Poison Control Center in their area by calling 800-222-1222. Individual callers will automatically be connected to the center covering their calling area.